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New Approaches for Household Energy Conservation; In Search for Personal Household Energy Budgets and Ditto Reduction Options

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Introduction

During the nineties it was increasingly acknowledged that households and lifestyles are entities relevant to the quest for ways of reducing long-term energy impacts [1]. Since most consumer activities take place within households, a large part of our resource use is performed by these households. Direct (energy for space heating, electricity and gasoline) and indirect (needed for the production, distribution and waste disposal of goods and services, e.g. the production of food) energy flows through households add up to about 80% of the total energy flows through society for the Netherlands [2].

In contrast with other sectors and in spite of several information campaigns over many years, the direct energy consumption in households is still rising. Besides the increase in direct energy also the indirect energy requirements per household increased. Wilting [2] calculated that Dutch households require about as much direct energy as indirect energy. Although indirect energy requirements are important when looking at household energy conservation, thus far most research focused only on direct energy.

The main determinants of the spread in energy requirements are income and household size. On household level you see a large spread in energy requirements even within a group with the same income and household size. This diversity makes it hardly possible to address households effectively by means of information in a more general way. Personalization of information could be a solution but is often very labor-intensive and time consuming. Because of the intensity of the contacts, feedback etc. such an experiment is only suitable for small groups, but the personal approach and the feedback appeared to be a powerful strategy.

The findings described above generate new research questions and possible solutions worthwhile to investigate like: is it possible to develop a large scale instrument which will be successful in reducing energy requirements in households. A more personal approach seems to have a good chance being successful. While direct energy only covers about 50% of the total household

energy requirements, the second question arises: is it possible to develop an instrument with which indirect energy in households can be measured in an easy way and can be reduced.

In the project presented here we developed a tool to address households, on the subject of energy conservation and, in such a way that:

- participants are approached more personal (reduction options and feedback)
- the approach will not be labor-intensive
- besides direct energy also indirect energy was taken into account.

The tool was tested and evaluated in a field experiment. The main questions in the evaluation were: did participants reduce their total energy requirements and was it possible to question and measure the indirect energy requirements and reductions.

The research was carried out as a field experiment with a group of 300 households in the city Groningen (the Netherlands). The combination of: personalization and feedback, indirect energy and scalability makes this experiment unique.

Tool

To develop a tool suitable for a scalable approach we choose for an interactive web-site. The challenge was to develop a web-site which looks good, was user friendly, personalized according to the questions as well as the energy reduction options and was able to gave feedback on the changed behavior. The questionnaire which stood central in this website addressed options for reducing direct energy as well as indirect energy requirements. The indirect energy requirements of consumer items were determined by a hybrid based easy to use Energy Analysis software program (EAP) developed by Wilting at the Center for Energy and Environmental Studies [2, 3, 4].

Experiment

Participants were selected on a voluntary base through advertisement in a local paper and direct mailing. In total 443 households responded positively but only 347 started the experiment.

The participants were randomly divided in two groups:

- an experimental group which received information about the objective, personalized reduction options and personalized feedback.
- a control group which was not exposed to interventions: this group received no objective no personalized reduction options and no feedback.

Of the 443 households which indicated to participate the experiment in the first place 190 (experimental group 137, control group 53) completed the experiment successfully.

Results

The results are summarized in table 1. The reduction % for the indirect part is not significant but the reduction for the direct part is clearly very significant.

Table 1. Average savings on household level.

	% reduction indirect energy	% reduction direct energy	% reduction total average
Experimental groups	-3.8%	+7.9%	+5.1%
Control group	-2.7% (0.632)*	-1.8% (0.000)*	-0.7%

* the values between brackets are the significances calculated by the univariate analyses of variance.

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